**Teaching The Concept of Photosynthesis: SBI 3C**

**SUMMARY**

**Background Information: Photosynthesis**

Photosynthesis is arguably the most important biochemical pathway in the organic world, since nearly all life depends on it. The very fact that humans get abundant oxygen to breathe is because of photosynthesis, also amplifies the importance of this process.

The level of carbon dioxide in the environment largely depends on the process of Photosynthesis. Industries and excessive number of vehicles on the road and other hazards of the modern era have led to increasing use of fuel and release of industrial waste and carbon monoxide which is critically fatal for our environment.

Interestingly, just as the increase in the carbon-dioxide level may harm the environment; similarly decrease in the level may cause the planet to freeze as carbon dioxide helps in keeping our planet warm and liveable. Photosynthesis helps in maintaining the balance in both situations.

**Curriculum Expectations**

* F3.1 describe the structure and physiology of the specialized plant tissues involved in conduction, support, storage, and photosynthesis
* F3.2 explain the chemical changes and energy transformations associated with the process of photosynthesis, and compare the reactants (i.e., carbon dioxide, radiant energy, water) to the products (i.e., glucose, oxygen)
* F3.4 explain the various roles of plants in the sustainability of the natural environment.

**Teaching Ideas**

* Use anticipation guide as a starting point to find out students ‘ prior knowledge about photosynthesis.
* Engage students in learning the concept by singing the song “ Photosynthesis”
* Independent reading from teacher’s selection of materials to deeper student understanding of the concept and gain concept vocabulary
* Have a kinesthetic representations by having students act out the steps of photosynthesis
* Develop understanding of the concept through researching
* Using differentiated instruction method through virtual labs to ensure the understanding of the concept
* Laboratory exploration of the factors involved photosynthesis
* Jigsaw activity of case study to help students make connection to real world scenarios
* A variety of assessment forms throughout the unit to improve student learning

**Lesson Sequence and teaching strategies**

**Lesson 1: Introduction to photosynthesis**

* Students will complete an anticipation guide for photosynthesis. The anticipation guide will be revisited to how students’ understanding has changed. ( see appendix A for the anticipation guide)
* Independent reading material of interest. ( Teacher collects a variety of books, magazines and newspaper articles on photosynthesis before the start of the unit) This activity will continue throughout the whole unit.

- Book talk: Student work in groups to share their article/book.

* video<http://www.teachertube.com/viewVideo.php?video_id=196913&title=Photosynthesis>
* Students work in groups to learn the song “ Photosynthesis”.
* Hand out the vocabulary sheet ( See appendix B) and tell students they will be completing a picture dictionary based on the vocabulary learned throughout the unit.

**Lesson 2: Organelles involved in photosynthesis and their functions**

Have students research organelles involved in photosynthesis on the Internet. Ask them to write down any words that are new to them, and answer the questions below. Have students work in pairs to answer the following questions:

* What organelles are involved in photosynthesis?
* Draw pictures of the organelles.
* What are the functions of those organelles involved in photosynthesis.

Each student will be asked to do further research on one organelle of their choice and they would come up with 5 questions about the organelle. They then would find a partner who searches on different organelle. They would present the info. to each other. After that students will work in groups of 4 and present 5 questions to group members. Group members will need to come up with answers to the questions.

**Lesson 3: The process of photosynthesis : Light reactions**

* Students watch two **animation tutorial** to learn about the process of light reactions.

[**http://dendro.cnre.vt.edu/forestbiology/photosynthesis.swf**](http://dendro.cnre.vt.edu/forestbiology/photosynthesis.swf)

<http://wps.prenhall.com/esm_freeman_biosci_1/0,6452,498648-,00.html>

* Students are required take notes when watching the video.
* Group discussion
* Teacher clarify any misconceptions students may have

**Lesson 4: The process of photosynthesis: Calvin Cycle**

**Students** watch animation tutorial to learn about the process of light reactions.

<http://www.wiley.com/college/boyer/0470003790/animations/photosynthesis/photosynthesis.htm>

* Students work in groups of two to revisit the anticipation guide.
* Have a whole class discussion of the questions in the anticipation guide.

**Lesson 5: The process of photosynthesis**

* Students learn the process by **acting** out the steps of photosynthesis. See appdndix C
* Students complete a game quiz as a review of the concept

[**http://www.neok12.com/quiz/PHOSYN02**](http://www.neok12.com/quiz/PHOSYN02)

**Lesson 6: Simulation Lab to explore factors involved in Photosynthesis**

Students work in pairs on one simulation lab of their choice.

Lab 1: <http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=395>

Students will be Studying photosynthesis in a variety of conditions. Oxygen production is used to measure the rate of photosynthesis. Light intensity, carbon dioxide levels, temperature, and wavelength of light can all be varied. Determine which conditions are ideal for photosynthesis, and understand how limiting factors affect oxygen production.

Lab 2:

**<http://www.mhhe.com/biosci/genbio/biolink/j_explorations/ch09expl.htm>**

This interactive exercise allows the user to explore how light influences photosynthesis. On the screen can be seen a chloroplast membrane in cross section, photons of light bashing into chlorophyll molecules and ejecting energetic electrons that pass from one membrane protein to another, leading to the production of ATP and NADPH. By varying the wavelength of the incident light, the user can construct an action spectrum of the photosynthetic pigment. By varying the light's intensity, the user can explore how the rate of photosynthesis depends upon the brightness of the light.

Lab 3:

<http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS12/LS12.html>

In this virtual lab, students will perform an experiment to investigate what colors of light spectrum cause the most plant growth. They will calculate the plant growth by measuring the height of each plant under different colors of light. They will compare these measurements and interpret a graph to determine which colors of the spectrum cause the most plant growth.

Students will complete an exploration sheet and meet in groups of 3 to share their exploration.

**Lesson 7 Lab: Rate of Photosynthesis**

Students will investigate rate of photosynthesis through experiment. They will complete a lab report.

See Appendix E

**Lesson 8:** **Deforestation and Global Warming**

* In this lesson, students apply their understanding of photosynthesis to a consideration of how trees can help reduce the negative impacts of the greenhouse effect. They will read a Web page describing the greenhouse effect, carbon dioxide's role as a greenhouse gas, and the role of humans in exacerbating this effect.
* Jigsaw activity : Case Study

Students form jigsaw groups of 4 and work on one case study of their interest. Students from different groups will then meet to share their case study.

[Cooling Off a Warming Planet](http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=582&id=582)

[Global Climate Change: Evidence and Causes](http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=478&id=478)

[Rising Temperatures, Differing Viewpoints](http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=182&id=182)

[The Petition: A Global Warming Case](http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=403&id=403)

Students will write a journal about their case study.

* Sudents will also browse the Web site of an organization that sponsors tree planting programs and consider how these programs might help reduce or slow down the increase of the greenhouse effect. They will conclude by writing paragraphs telling younger kids about the benefits of trees and plants.

Culminating Task: Students will create a website about photosynthesis based on the rubrics given by teacher using www. Webstarts.com to share with other students in the school .

**Potential Student Difficulties/Misconceptions**

The process is difficult to visualize because the molecules involved in the process are so small.

**“Plants get most of their food from the soil. This is why fertilizers are needed.”** Plants are autotrophs, meaning they create their own food from inorganic substances and energy. The Plant takes inorganic substances and water from the soil, not food.

**Photosynthesis occurs during the day, and at night, plants respire.** Photosynthesis includes the light reactions and the light-independent reactions. Both sets of reactions together comprise the suite of reactions that we refer to as "photosynthesis". The requirement of light means that plants can only perform the full set of photosynthetic reactions during hours of the day when light is present. The reactions of respiration have no such dependency on light, but the accessible chemical energy carried in the ATP produced during respiration is needed at all times—day and night—in order to power the living cells that constitute the plant. Plants therefore must respire every second of their lives; when respiration stops, death begins.

**“Photosynthesis requires a green plant.”** Photosynthesis requires the presence of photosynthetic pigment, chlorophyll, found in green plants, but there are other pigments found in brown plants, red plants, and certain seaweeds that trap wavelengths of light that cannot be absorbed by chlorophyll alone.

**“Photosynthesis is a simple process.”** Although we often show it as a series of 3 or 4 reactions, photosynthesis actually consists of 80-100 different, but interconnected, chemical reactions. Cellular respiration, essentially the reverse of photosynthesis, also consists of around 100 chemical reactions.

**Differentiated Assessment**

1. Assessment for learning: Anticipation guide, Q&A
2. Assessment as learning:

* Observation
* Classroom discussion
* Vocabulary quiz
* Quiz game
* Lab exploration sheet
* Lab report
* Case study
* Journal writing
* Writing assignment

1. Assessment of learning
   * Unit Test
   * Culminating activity: create a web page

**Applications & Societal Implications**

Deforestation is the removal of a forest or stand of trees where the land is thereafter converted to a non-forest use. Examples of deforestation include conversion of forestland to farms, ranches, or urban use. When we remove and do not replace forestry, we are removing our source for oxygen creation in the environment. When deforestation is performed by burning, it not only destroys our supply of oxygen, but the burning releases even more carbon dioxide into the environment.

**Global Warming:** refers to an increase in the earth's average atmospheric temperature that causes corresponding changes in climate and that may result from the greenhouse effect.

**The Greenhouse Effect:** an atmospheric heating phenomenon, caused by short-wave solar radiation being readily transmitted inward through the earth's atmosphere but longer-wavelength heat radiation less readily transmitted outward, owing to its absorption by atmospheric carbon dioxide, water vapor, methane, and other gases; thus, the rising level of carbon dioxide is viewed with concern.

Thus, global warming is significantly affected by the rise in carbon dioxide levels in the atmosphere which are due to many reasons (deforestation, pollution etc) and therefore an increase in plants/trees preforming photosynthesis could mean that we have more oxygen, less carbon dioxide, and less effects of global warming!

**Opportunity For Student Reflection**

What are some things you can do in your daily life that could aid in reducing deforestation and global warming?

**Appendix A**

**ANTICIPATION GUIDE: PHOTOSYNTHESIS**

Before each of the statements below, write agree / disagree in the blank space.

This exercise will be repeated after our study, and as a quiz.

1. \_\_\_\_\_\_\_\_\_\_ Plants need water to make sugars.

2. \_\_\_\_\_\_\_\_\_\_ Plants do photosynthesis in order to feed us.

3. \_\_\_\_\_\_\_\_\_\_ The entire process of Photosynthesis occurs only in the light.

4. \_\_\_\_\_\_\_\_\_\_ Plants use more green light than any other wavelength of light.

5. \_\_\_\_\_\_\_\_\_\_ Most of the oxygen on Earth comes from the rain forests.

6. \_\_\_\_\_\_\_\_\_\_ The purpose of photosynthesis is to produce glucose.

7. \_\_\_\_\_\_\_\_\_\_ The purpose of photosynthesis is to produce Oxygen.

8. \_\_\_\_\_\_\_\_\_\_ Plants use the oxygen that they produce.

9. \_\_\_\_\_\_\_\_\_\_ At night plants respirate (‘breath’) more rapidly.

10. \_\_\_\_\_\_\_\_\_ All organisms on earth depend on photosynthesis for energy.

11. \_\_\_\_\_\_\_\_\_ Carnivorous plants do not need to do photosynthesis.

12. \_\_\_\_\_\_\_\_\_ Plants get all their food from the soil.

Choose two statements you disagree with and explain your answer:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Appendix B** **PHOTOSYNTHESIS VOCAB**

AUTOTROPH HETEROTROPH

ADENOSINE LIGHT-DEPENDENT

TRIPHOSPHATE (ATP) REACTION

PIGMENT CHLOROPHYLL

THYLAKOID STROMA

GRANUM PHOTOSYNTHESIS

NADP+ THYLAKOID SPACE

ATP SYNTHASE CALVIN CYCLE

CHLOROPLAST SUNLIGHT

ELECTRONS WAVELENGTH

RED & BLUE-VIOLET CARBONDIOXIDE

LIGHT

WATER

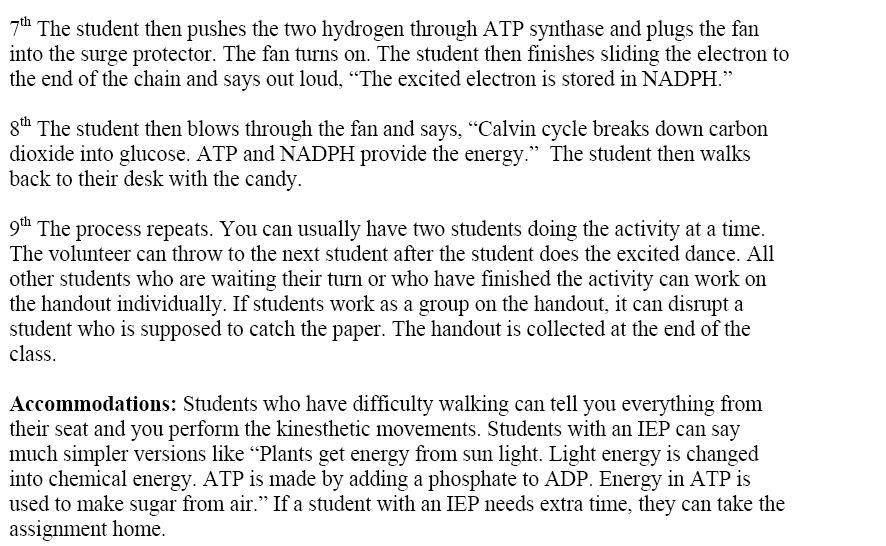
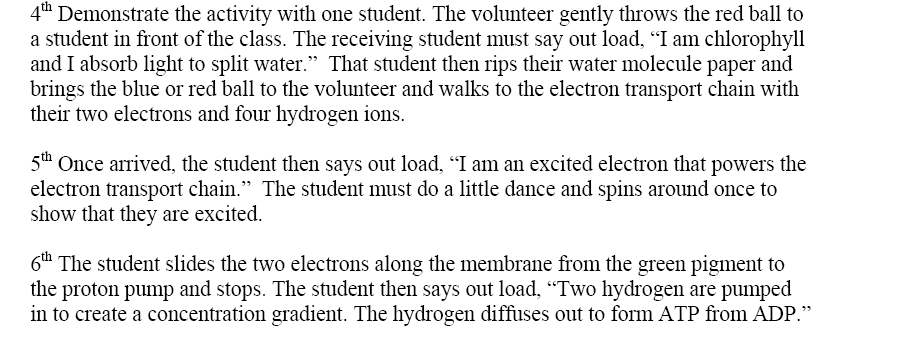
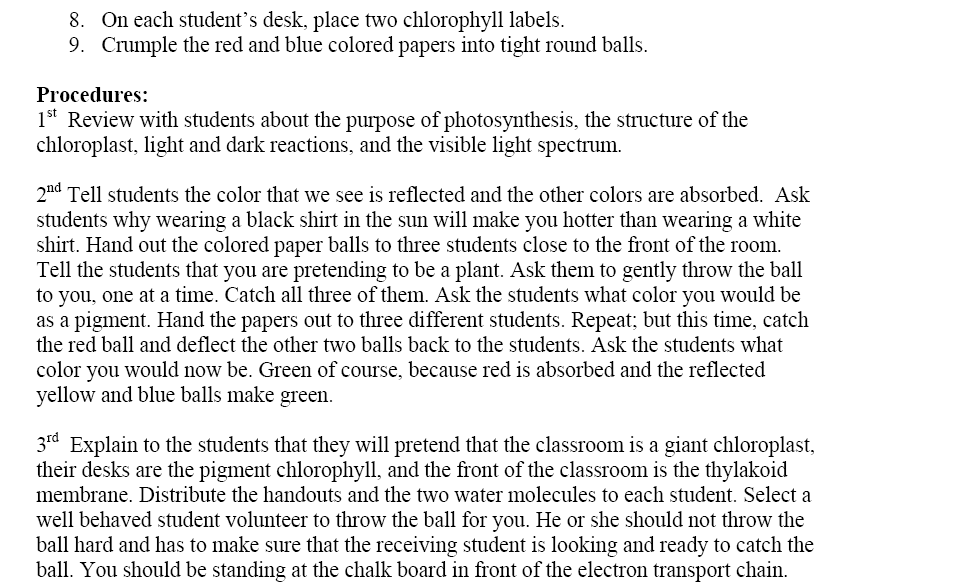
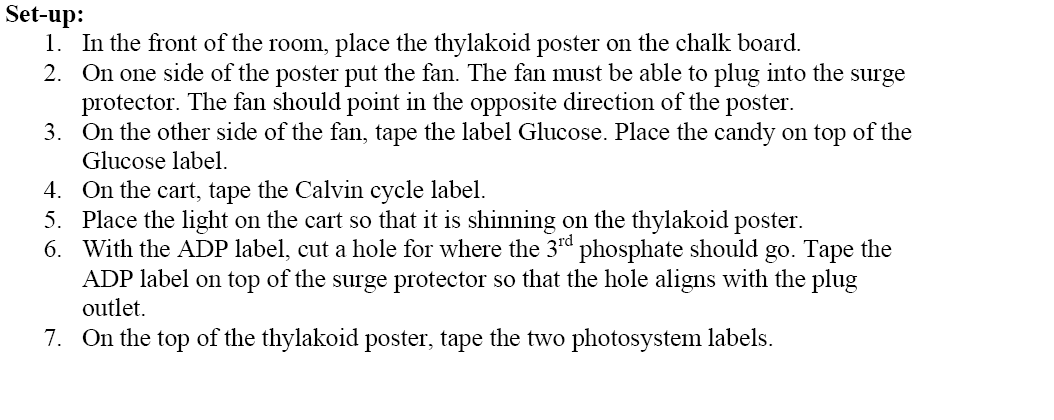
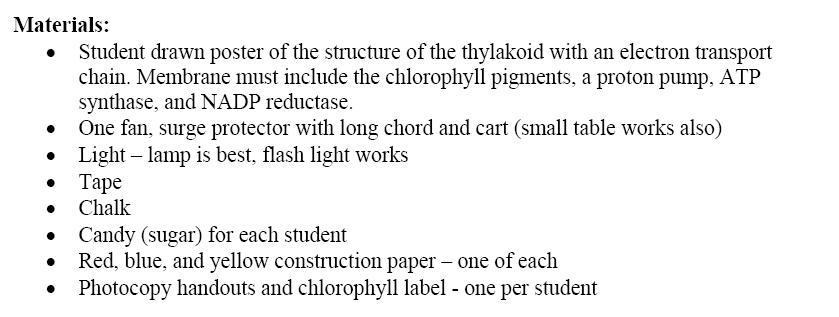
OXYGEN

GLUCOSE CAROTENOID

## Appendix C: Lyrics

**Chorus**  
Photosynthesis, let’s get into this  
Discussion of sunlight, and transfer of energy.  
Photosynthesis, let’s get into this  
Process of chemical reactions and synergy.  
  
**Verse I**  
Plants take water, sun, and CO2,  
to make glucose: the sugar that they use for food  
They also put oxygen into the air  
So we can share, because oxygen is everywhere  
The energy transforms from solar to chemical  
All the time, everywhere, the process is identical  
In every plant, and every tree  
Enabling all living things to be  
  
**Chorus**  
  
**Verse II**  
Let’s take a look at the light reaction  
Making chemical energy when light is captured  
electrons flow through the photo systems  
Flowing so fast you might have missed ‘em  
Within the chloroplast lies the action  
The thylakoid membrane is where it happens  
ATP and NADPH  
Are products of light, water, air, and space  
  
**Chorus**  
  
**Verse III**  
The Calvin cycle, or dark reaction  
Doesn’t need direct sunlight for it to run right.  
CO2 from the air enters the chloroplast  
Mixing with organic molecules for the last time  
With the help of the enzyme Rubisco  
Carbon Fixation—I thought you knew this yo!  
It forms a carbohydrate known as G3P  
It’s created, recreated, and recycled you see  
  
**Chorus**  
  
**Bridge**  
Leaves on trees and even weeds meet needs  
Making oxygen we need to breathe  
You want to learn it with ease? You want to master the keys?  
It’s photosynthesis, listen to this please  
  
**Chorus**

## Appendix D



## Appendix E

**Lab: Rate of Photosynthesis**

Photosynthesis is the process by which plants take carbon dioxide from the atmosphere, add water, and use the energy of sunlight to produce sugar. Write the equation for photosynthesis:

Photosynthesis occurs in the chloroplast, an organelle in plant cells that contains the molecule chlorophyll. Chlorophyll absorbs the energy of sunlight. That light energy is converted to chemical energy through the steps of photosynthesis.   
The reactions of photosynthesis can be divided into two major types: light-dependent reactions and light-independent reactions. The light-dependent reactions convert energy from the sun into a form that the chloroplast can then use to make sugar from carbon dioxide, in the process producing oxygen as a waste product. The light-independent reactions use that energy to make glucose from carbon dioxide and water.

Materials: test tube, Elodea cuttings, sodium bicarbonate (baking soda), beaker with water, lamp

**Procedure:**

1. Obtain a sprig of elodea. Remove several leaves from around the cut end of the stem. Slice off a portion of the stem at an angle and lightly crush the cut end of the stem.   
2. Place the sprig in a test tube, cut side up. Add water to test tube and a pinch of baking soda.  
3. Place the test tube into a beaker filled with tap water.  
3. Place a lamp next to the beaker. - The water in the beaker will help to absorb the heat from the light, thus reducing the variables in the experiment  
4. Turn on the lamp. As soon as see small bubbles coming from the cut end of the stem, time the reaction for 10 minutes. If you do not see bubbles, cut the stem again and recrush.  
5. Calculate the net photosynthesis in bubbles/min. (Divide the number of bubbles by 10 minutes.)   
6. Remove your test tube from the bright light. Observe and record the rate of bubbles without direct light.

**Data**

|  |  |
| --- | --- |
| Bright Light  Bubbles/min \_\_\_\_\_\_\_\_\_\_ | Dim Light  Bubbles/min \_\_\_\_\_\_\_\_\_\_\_\_ |

**Analysis**

1. What are the bubbles? Explain why bubbles happen.

2. Did the number of bubbles change when the light intensity was reduced? Explain why this would occur.

3. Why was the test tube placed in a beaker of water? What is a variable and why is it important to eliminate them?

4. What was the purpose of adding sodium bicarbonate (baking soda) to the plant? Hint: look at the formula for photosynthesis

## Appendix F Vocabulary exercise

**PHOTOSYNTHESIS STARTS WITH**

1. Molecules that collect light energy are called \_P\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ .

2. Chlorophyll a and b absorb \_B\_ \_\_ \_\_ \_\_-\_V\_ \_\_ \_\_ \_\_ \_\_ \_\_ and \_R\_ \_\_ \_\_ wavelengths of light best.

3. \_C\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ is the main light absorbing pigment found in green plants.

4. Plants “look” green because chlorophyll \_R\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ green light.

5. Organisms, like green plants, that can make their own food using energy from the sun are called   
 \_A\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_.

6. The gel-filled space inside the chloroplast surrounding the thylakoid stacks is called the

\_S\_ \_\_ \_\_ \_\_ \_\_ \_\_.

7. \_P\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ I and II contain chlorophyll and absorb light energy during the \_L\_ \_\_ \_\_ \_\_ \_\_ \_D\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ reactions.

8. During the light dependent reactions, H+ ions build up in the \_T\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ space when \_W\_ \_\_ \_\_ \_\_ \_\_ molecules are split.

9. The enzymes for the light dependent reactions are found in the \_T\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_   
 \_M\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ , while the Calvin cycle happens in the \_S\_ \_\_ \_\_ \_\_ \_\_ \_\_.

10. The stacks of thylakoids found inside chloroplasts are called \_G\_ \_\_ \_\_ \_\_ \_\_ .

11. The light independent reactions are also called the \_C\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_C\_ \_\_ \_\_ \_\_ \_\_.

12. \_J\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_P\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ used a bell jar, candle, and plant to show plants give off something that candles need to burn.

13. Carbon and oxygen from \_C\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_D\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ end up as part of a

\_G\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ molecule following the Calvin cycle.

14. \_A\_ \_\_ \_\_ and \_N\_ \_\_ \_\_ \_\_ \_\_ are made during the \_L\_ \_\_ \_\_ \_\_ \_\_ dependent reactions and   
 carry energy and high energy electrons that are used during the Calvin cycle to produce   
 \_S\_ \_\_ \_\_ \_\_ \_\_ \_\_, like glucose.

15. The O in H2O is given off as\_O\_ \_\_ \_\_ \_\_ \_\_ \_\_ gas to the atmosphere when water is split during   
 the light dependent reactions.

16. Proteins in living things that help chemical reactions happen are called \_E\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ .

17. Electrons are transferred along the membrane from Photosystem II to Photosystem I using the

\_E\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_T\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_S\_ \_\_ \_\_ \_\_ \_\_ \_\_ .

18. The movement of H+ ions from the thylakoid space, across the membrane, and into the stroma causes   
 \_A\_ \_\_ \_\_ \_S\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ to spin and produce ATP,

19. \_M\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_C\_ \_\_ \_\_ \_\_ \_\_ \_\_ received the Nobel prize for figuring out the

biochemical pathway used by plants to make glucose.

20. \_J\_ \_\_ \_\_ \_I\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ showed that plants only produce oxygen when exposed to light.

21. \_J\_ \_\_ \_\_ \_V\_ \_\_ \_\_ \_H\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ carefully measured the mass of a growing plant   
 and concluded the increase came from water.

22. Orange and yellow colored pigments called \_C\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ absorb different wavelengths of light and help chlorophyll use more of the sun’s energy.

23. \_T\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ \_\_ , amount of \_W\_ \_\_ \_\_ \_\_ \_\_ , and \_L\_ \_\_ \_\_ \_\_ \_\_ intensity are all factors that affect the rate of photosynthesis.

## Appendix G Review

**WHAT SHOULD I KNOW ABOUT PHOTOSYNTHESIS**

What is an autotroph? A Heterotroph? Be able to give examples.

Which molecule is used by living things to store and transfer energy?

What are the parts of an ATP molecule?

Write the equation that shows how ADP is changed into ATP.

Write the equation that shows how ATP is changed into ADP.

Which molecule stores more than 90 times the energy in ATP? How are these used by cells?

How do animal cells store glucose for later? How do plants store glucose for later?

light

Be able to write the chemical equation for photosynthesis: 6 CO2 + 6 H20 → C6H12O6 + 6 O2

What is a pigment? What is the main pigment used by green plants to absorb energy?

What are the 2 kinds of chlorophyll?

Which wavelengths of light are best absorbed by chlorophyll a & b? Which are reflected?

How are carotenoid pigments different from chlorophyll? Why do plants have these other pigments besides chlorophyll? Why do plants look green?

Be able to label the parts of a chloroplast and tell where the reactions for photosynthesis happen.

What is NADP+? What does it do? How is it changed into NADPH?

Where does the H that ends up in NADPH ultimately come from?

Be able to describe the two sets of reactions involved in photosynthesis   
 (Light-dependent & Calvin cycle)

Where are they located and what happens in each?

Be able to identify the molecules that participate in the light-dependent reactions and tell what they do.

Why does Photosystem II come before Photosystem I in the light-dependent reactions?

What is another name for the Calvin Cycle?

Which reactions in photosynthesis require light? Which do not?

How and where are ATP and NADPH made?

What happens to water during the light-reaction?

Which molecule is given off as a waste gas?

Which molecules produced by the light-dependent reaction are used during the Calvin cycle?

What happens during the Calvin cycle?

Be able to give reactants and products for each of the reactions.

Where does the carbon and oxygen in glucose ultimately come from?

Where does the hydrogen in glucose ultimately come from?

Which factors affect the rate of photosynthesis and how?

**References**

* [**http://en.wikibooks.org/wiki/Transwiki:Photosynthesis\_misconceptions**](http://en.wikibooks.org/wiki/Transwiki:Photosynthesis_misconceptions)This site gave ideas regarding common student misconceptions in understanding the process of photosynthesis
* [**http://en.wikipedia.org/wiki/Deforestation**](http://en.wikipedia.org/wiki/Deforestation)This site gave the definition of deforestation
* [**http://www.global-greenhouse-warming.com/deforestation.html**](http://www.global-greenhouse-warming.com/deforestation.html)This site provided information regarding the effects of deforestation on global warming and the greenhouse effect
* [**http://dictionary.reference.com/browse/global+warming**](http://dictionary.reference.com/browse/global+warming)This site provided the definition for global warming
* [**http://whatisphotosynthesis.net/photosynthesis-and-environment.php**](http://whatisphotosynthesis.net/photosynthesis-and-environment.php)This website was useful for information regarding the overall importance for photosynthesis to be used as background information
* [**http://www.sciencegeek.net/Biology/review/U2PhotoFillin.htm**](http://www.sciencegeek.net/Biology/review/U2PhotoFillin.htm)

This website provides “ Gap Fill” exercise.

* [**http://www.marric.us/files/HS\_2\_ANTICIPATION\_GUIDE\_Photosynthesis.doc**](http://www.marric.us/files/HS_2_ANTICIPATION_GUIDE_Photosynthesis.doc)

This website provide anticipation guide

* [**http://www.teachertube.com/viewVideo.php?video\_id=196913&title=Photosynthesis**](http://www.teachertube.com/viewVideo.php?video_id=196913&title=Photosynthesis) song about photosynthesis

* **<http://local.brookings.k12.sd.us/biology/WORKSHEETS/ch%208%20photosyn/BINGOphotosynthesis.doc>**

vocabulary bingo game

* [**http://local.brookings.k12.sd.us/biology/photosynthesis.htm#WORKSHEETS/HANDOUTS**](http://local.brookings.k12.sd.us/biology/photosynthesis.htm#WORKSHEETS/HANDOUTS) worksheet

[**http://www.neok12.com/quiz/PHOSYN02**](http://www.neok12.com/quiz/PHOSYN02) quiz game

* [**http://local.brookings.k12.sd.us/biology/photosynthesis.htm**](http://local.brookings.k12.sd.us/biology/photosynthesis.htm)excellent activities for photosynthesis
* <http://sciencecases.lib.buffalo.edu/cs/collection/results.asp?search=global+warming&subject_headings=&educational_level=&type_methods=&topical_areas>=

This website provides case studies.

* [**http://www.biologycorner.com/worksheets/photosynthesis\_rate.html**](http://www.biologycorner.com/worksheets/photosynthesis_rate.html)photosynthesis experiment